

Atty. Dkt. 11-934
Dkt. 1417

U.S. PATENT APPLICATION

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Invention: IMPROVED/ALTERNATE METHOD FOR APPLYING HOT MELT
ADHESIVES TO CARPET

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SPECIFICATION

TITLE OF THE INVENTION

IMPROVED/ALTERNATE METHOD FOR APPLYING HOT MELT ADHESIVES TO CARPET

BACKGROUND OF THE INVENTION

[0001] This invention relates to carpets and methods of making carpets employing an efficient procedure for applying hot melt adhesive to a carpet backing.

[0002] Carpets are constructed with a primary backing material in which yarns are tufted through a primary backing material having a face surface and a back surface. An adhesive is used on the back side of the primary backing to secure the face yarns to the primary backing. Traditionally these adhesives may be latex or PVC-based materials. This invention uses hot melt adhesives based upon polymers which when heated have reduced viscosity and are flowable but upon cooling secure the carpet yarns to the primary backing.

[0003] Roller coating and extrusion coating are two methods that have been used to successfully apply a hot melt adhesive to the back of the carpet primary backing. The hot melt adhesive has many purposes and advantages over conventional latex and PVC backed carpets. The purposes of the adhesives used in carpet manufacturing are to encapsulate the individual fibers or filaments in the fiber bundle of such yarns to lock them in place to prevent foot traffic from causing the fibers or filaments to break and pill. The adhesive also locks the bundles of yarn in place so that they are unable to be pulled out of the carpet, as well as adhere a secondary backing, if desired, to the back of the carpet, prevent moisture from being able to pass through the adhesive layer, and allows the carpet to be easily recycled by constructing the entire carpet product of recoverable polymers. Roller coating, though effective, typically requires a large mass of adhesive in order to be effective. Extruders, which are very effective, are extremely expensive.

[0004] We have found that hot melt adhesives can be applied to the back of a carpet primary backing and effectively meet all the objectives stated above by using a slot

coat system. A slot coat system has proven to be more successful than roll coaters and just as effective as extruders while being much more cost effective. In appearance, a slot coater visually looks very similar to an extruder. A conventional extruder melts a polymer and forces it through a die via the use of screws. Extrusion coating using an ethylene polymer-based adhesive is described in WO 98/38374, WO 98/38375 and WO 98/38376. A slot coater melts the polymer which is then gravity fed to a series of pumps which pump the material through any number of application heads such as sprayers, misters, slot dies, and the like.

[0005] Generally the adhesive backing material is applied as a single coating or layer which affixes the yarn to the primary backing material. The extent or tenacity to which the yarn is affixed is referred to as tuft lock or tuft bind strength. Carpets with sufficient tuft bind strength exhibit good wear resistance and have long service lives. It is also desirable that the adhesive material should substantially penetrate the yarn or fiber bundle exposed on the back side of the primary backing material and should substantially consolidate individual fibers within the yarn. Good penetration of the yarn and consolidation of fibers leads to good abrasion resistance and improved wear characteristics.

[0006] In most applications a secondary backing material, typically a lightweight scrim made of a woven or non-woven material is applied to the back side of the carpet and is bonded onto the adhesive backing material. The secondary backing material provides enhanced dimensional stability to the carpet structure.

[0007] Hot melt adhesive materials suited to the process of the present invention are primarily thermoplastic polyolefins such as ethylene vinyl acetate copolymers, polyethylenes, particularly low density polyethylene as well as polyethylene, polypropylene, polyamide, polyvinyl chloride, ethylene vinyl acetate, polyester or copolymers thereof. We have found, in addition to a hot melt adhesive, that it is advantageous to employ a secondary amount or minor amount of a tackifying resin that is blended with the hot melt adhesive. The choice of tackifying resin will depend on several factors including compatibility with the hot melt adhesive both in terms of processing

conditions and application conditions and as well as relative costs. Generally the tackifying resins are more costly than the hot melt adhesives.

BRIEF SUMMARY OF THE INVENTION

[0008] Described are methods of making a carpet by (a) providing a primary backing material having a front side and a back side, (b) tufting a yarn into the primary backing material to produce a carpet pile on the front side of the primary backing material and loops of the yarn on the back side of the primary backing material, (c) applying by slot coating a layer of a first melted coating composition onto the back side of the tufted primary backing material, (d) applying by slot coating a layer of a second melted resin/adhesive coating composition onto the coating applied in step (c) thereby fixing the loops of the yarn to the primary backing material, and (e) applying and pressing a secondary backing onto the slot coated tackifying resin layers and pressing it to join the first and second tackifying resins and the primary backing and secondary backing and yarn loops together to form a cohesive carpet product.

[0009] The first coating composition may include a tackifying resin and a hot melt adhesive. Typically between about 2 to about 12 ounces per square yard of the first resin coating composition is applied to the primary backing material. The second resin coating composition may contain up to 80% by weight of a tackifying resin blended together with a hot melt adhesive. Between about 5 to about 50 ounces per square yard of the second coating composition is applied to the primary backing. Overall, between about 24 and about 50 ounces per square yard of the first and second coating compositions combined are applied to the primary backing. The hot melt adhesive is preferably a composition based upon a polyethylene, polypropylene, polyamide, polyvinyl chloride, ethylene vinyl acetate, polyester or their copolymers. The second coating composition may include an inorganic particulate filler. Desirably the carpet is constructed substantially entirely of recyclable polymer.

[0010] Also described are methods of making a carpet including the steps of providing a primary backing material having a front side and a back side, tufting a yarn

into the primary backing material to produce a carpet pile on the front side of the primary backing material and loops of the yarn on the back side of the primary backing material, and thereafter applying by slot coating a layer of a melted adhesive composition onto the back side of the tufted primary backing material thereby fixing the loops of the yarn to the primary backing material.

[0011] The method of this invention provides a carpet comprised of yarn attached to a primary backing material and secured to the backing by applying to a back side of the primary backing material a slot coated melted adhesive composition thereby flexibly securing the yarn to and retaining it in the primary backing material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIGURE 1 is a schematic illustration of applying by slot coating an adhesive composition to a primary carpet backing, applying a secondary backing and preparing a carpet.

DETAILED DESCRIPTION OF THE INVENTION

[0013] The invention is further described with respect to the attached Figure illustrating an embodiment of the invention in which two slot coating stations are employed. The first applies a tackifying resin or a blend of tackifying resin and a hot melt adhesive as a pre-coat and a second slot coat station applies a blend of a tackifying resin and a hot melt adhesive, optionally including a filler, such as calcium carbonate or flyash, applied as a main coat. The two slot coaters are positioned in close proximity to one another to apply both layers of adhesive composition while hot and somewhat fluid. The number of slot coaters used depends upon factors such as physical properties the carpet is required to satisfy, and cost. For example, physical properties achieved with one unit may be sufficient for residential carpet but not for commercial carpet or carpet tile.

[0014] The process of the present invention is characterized by the use of one or more slot coating devices which are distinguished from other application devices, in particular extruders, that have been used in this art, as noted above. An extruder uses a

series of screws and pumps to force the adhesive material through a die onto the primary backing. In contrast, a slot coater uses only pumps to force the adhesive through a die and then onto the primary backing. Slot coating holds the advantage of efficiently and precisely applying a desired amount of adhesive composition to the carpet but at a rate of application lower than that of other coating techniques including extrusion coating. The carpets made according to the present invention are strong, lightweight and more flexible as a result of employing smaller quantities of adhesive, yet meet the necessary product specifications and requirements.

[0015] Referring again to the Figure, once the two adhesive layers are slot coated onto the primary backing the secondary backing is joined to the back coated primary and compressed together by squeeze rolls or the like to unify the primary and secondary backing with the adhesive layer or layers therebetween and secure the tufted fibers to the back surface of the primary backing. After cooling to solidify the coatings, the finished carpet is then rolled in open width or further processed into smaller units, for instance, carpet tiles. The secondary backing material may be a woven fabric or a non-woven fabric, such as spun-bond, wet-laid, melt-blown or air entangled and is preferably made from a polyolefin to facilitate recycling.

[0016] The use of two separate slot coating stations allows for considerable flexibility in not only the amounts of adhesive applied but also the content of the adhesive composition in particular when blends of adhesive components are employed. Desirably the coating weight of all adhesive layers is in the range of about 24 to about 50 ounces per square yard and if two layers are applied the tackifying layer is generally in the range of two to 12 ounces per square yard, preferably about nine ounces per square yard and the second adhesive layer is generally applied in an amount of five to about 50 ounces per square yard, preferably about 15 ounces per square yard. Usually the first adhesive composition applied consists entirely or substantially entirely of a tackifying resin or it may be a blend of tackifying resin and a hot melt adhesive in which case the amount of tackifying resin exceeds that of the hot melt adhesive. Conversely, if the blend of tackifying resin and hot melt adhesive is employed as the second adhesive

composition, the amount of tackifying resin is less than that of the amount of hot melt adhesive.

[0017] As illustrations of coating compositions suitable for the process of this invention, the first coating layer may consist entirely of a tackifying resin or up to 30 parts by weight of an adhesive may be included together with the tackifying resin in the composition. Compositions for the second layer may range from 80 to 20 parts by weight of tackifying resin and 20 to 80 parts by weight adhesive. When a filler is included in the second layer the tackifying resin component ranges from 10 to 70 parts by weight, the adhesive component 22 to 52 parts by weight, and the filler component 8 to 38 parts by weight, with a total of 100 parts by weight.

[0018] Our experience has indicated that when compared with roll coaters the use of slot coating provides a reduction of about 40% in the amount of adhesive employed, leading to not only reduced costs but also greater flexibility and lighter weight of the finished product.

[0019] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.